

RAW SEQUENCE LISTING  
PATENT APPLICATION: US 09/646,925

DATE: 10/11/2001  
TIME: 10:28:36

Input Set : A:\Sequence Listing.txt  
Output Set: N:\CRF3\10112001\I646925.raw

3 <110> APPLICANT: CHATFIELD, STEVEN N.  
5 <120> TITLE OF INVENTION: ATTENUATED BACTERIA USEFUL IN VACCINES  
7 <130> FILE REFERENCE: 117-320  
9 <140> CURRENT APPLICATION NUMBER: US 09/646,925  
C--> 10 <141> CURRENT FILING DATE: 2001-01-31 8V  
12 <150> PRIOR APPLICATION NUMBER: PCT/GB99/00935  
13 <151> PRIOR FILING DATE: 1999-03-25  
15 <150> PRIOR APPLICATION NUMBER: GB 9806449.6  
16 <151> PRIOR FILING DATE: 1998-03-25  
18 <160> NUMBER OF SEQ ID NOS: 28  
20 <170> SOFTWARE: PatentIn Ver. 2.1  
22 <210> SEQ ID NO: 1  
23 <211> LENGTH: 1690  
24 <212> TYPE: DNA  
25 <213> ORGANISM: Escherichia coli  
27 <220> FEATURE:  
28 <221> NAME/KEY: CDS  
29 <222> LOCATION: (492)..(1562)  
31 <400> SEQUENCE: 1  
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34 cacggctctga tccacaacgt cattccgatt cgttccgatc tttccgcga cttccgaaa 120  
36 gtgcagtacg acctgattgt caactaaccgc cctatgtcg atgcgaat atgtccgacc 180  
38 tgccaaacaa taccgcacg agccggaaact gggcctggca tctggcactg acggcctgaa 240  
40 actgacgcgt tgcattctcg gtaacgcggc agattacctt gctgtatgtg gcgtgttgc 300  
42 ttgtgaagtc ggcacacagca tggtacatct tatggaccaa tatccggatg ttccgttac 360  
44 ctggctggag tttgataacg gccgcgttgc tttgtttatg ctcaccaaag agcagctt 420  
46 tgccgcacga gaacatttcg cgattataaa agattaagta aacacgc当地 cacaacaata 480  
48 acggagccgt g atg gct gga aac aca att gga caa ctc ttt cgc gta acc 530  
49 Met Ala Gly Asn Thr Ile Gly Gln Leu Phe Arg Val Thr  
50 1 5 10  
52 acc ttc ggc gaa tcg cac ggg ctg gcg ctc ggc tgc atc gtc gat ggt 578  
53 Thr Phe Gly Glu Ser His Gly Leu Ala Leu Gly Cys Ile Val Asp Gly  
54 15 20 25  
56 gtt ccg cca ggc att ccg ctg acg gaa gcg gac ctg caa cat gac ctc 626  
57 Val Pro Pro Gly Ile Pro Leu Thr Glu Ala Asp Leu Gln His Asp Leu  
58 30 35 40 45  
60 gac cgt cgt cgc cct ggg aca tcg cgc tat acc acc cag cgc cgc gag 674  
61 Asp Arg Arg Arg Pro Gly Thr Ser Arg Tyr Thr Gln Arg Arg Glu  
62 50 55 60  
64 ccg gat cag gtc aaa att ctc tcc ggt gtt ttt gaa ggc gtt act acc 722  
65 Pro Asp Gln Val Lys Ile Leu Ser Gly Val Phe Glu Gly Val Thr Thr  
66 65 70 75  
68 ggc acc agc att ggc ttg ttg atc gaa aac act gac cag cgc tct cag 770  
69 Gly Thr Ser Ile Gly Leu Leu Ile Glu Asn Thr Asp Gln Arg Ser Gln  
70 80 85 90  
72 gat tac agt gcg att aag gac gtt ttc cgt cca ggc cat gcc gat tac 818  
73 Asp Tyr Ser Ala Ile Lys Asp Val Phe Arg Pro Gly His Ala Asp Tyr

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74	95	100	105	
76	acc tac gaa caa aaa tac ggt ctg cgc gat tat cgc ggc ggt gga cgt			866
77	Thr Tyr Glu Gln Lys Tyr Gly Leu Arg Asp Tyr Arg Gly Gly Arg			
78	110	115	120	125
80	tct tcc gcc cgc gaa acc gcc atg cgc gtg gcg gca gga gct att gcc			914
81	Ser Ser Ala Arg Glu Thr Ala Met Arg Val Ala Ala Gly Ala Ile Ala			
82	130	135	140	
84	aaa aaa tat ctc gcc gag aaa ttt ggt att gaa atc cgt ggc tgc ctg			962
85	Lys Lys Tyr Leu Ala Glu Lys Phe Gly Ile Glu Ile Arg Gly Cys Leu			
86	145	150	155	
88	acc cag atg ggc gac att ccg ctg gat atc aaa gac tgg tcg cag gtc			1010
89	Thr Gln Met Gly Asp Ile Pro Leu Asp Ile Lys Asp Trp Ser Gln Val			
90	160	165	170	
92	gag caa aat ccg ttt ttt tgc ccg gac ccc gac aaa atc gac gcg tta			1058
93	Glu Gln Asn Pro Phe Phe Cys Pro Asp Pro Asp Lys Ile Asp Ala Leu			
94	175	180	185	
96	gac gag ttg atg cgt gcg ctg aaa aaa gag ggc gac tcc atc ggc gct			1106
97	Asp Glu Leu Met Arg Ala Leu Lys Lys Glu Gly Asp Ser Ile Gly Ala			
98	190	195	200	205
100	aaa gtc acc gtt gtt gcc agt ggc gtt cct gcc gga ctt ggc gag ccg			1154
101	Lys Val Thr Val Val Ala Ser Gly Val Pro Ala Gly Leu Gly Glu Pro			
102	210	215	220	
104	gtc ttt gac cgc ctg gat gct gac atc gcc cat gcg ctg atg agc atc			1202
105	Val Phe Asp Arg Leu Asp Ala Asp Ile Ala His Ala Leu Met Ser Ile			
106	225	230	235	
108	aac gcg gtg aaa ggc gtg gaa att ggc gac ggc ttt gac gtg gtg gcg			1250
109	Asn Ala Val Lys Gly Val Glu Ile Gly Asp Gly Phe Asp Val Val Ala			
110	240	245	250	
112	ctg cgc ggc agc cag aac cgc gat gaa atc acc aaa gac ggt ttc cag			1298
113	Leu Arg Gly Ser Gln Asn Arg Asp Glu Ile Thr Lys Asp Gly Phe Gln			
114	255	260	265	
116	agc aac cat gcg ggc att ctc ggc ggt atc agc agc ggg cag caa			1346
117	Ser Asn His Ala Gly Gly Ile Leu Gly Gly Ile Ser Ser Gly Gln Gln			
118	270	275	280	285
120	atc att gcc cat atg gcg ctg aaa ccg acc tcc agc att acc gtg ccg			1394
121	Ile Ile Ala His Met Ala Leu Lys Pro Thr Ser Ser Ile Thr Val Pro			
122	290	295	300	
124	ggt cgt acc att aac cgc ttt ggc gaa gaa gtt gag atg atc acc aaa			1442
125	Gly Arg Thr Ile Asn Arg Phe Gly Glu Glu Val Glu Met Ile Thr Lys			
126	305	310	315	
128	ggc cgt cac gat ccc tgt gtc ggg atc cgc gca gtg ccg atc gca gaa			1490
129	Gly Arg His Asp Pro Cys Val Gly Ile Arg Ala Val Pro Ile Ala Glu			
130	320	325	330	
132	gcg aat gct ggc gat cgt ttt aat gga tca cct gtt acg gca acg ggc			1538
133	Ala Asn Ala Gly Asp Arg Phe Asn Gly Ser Pro Val Thr Ala Thr Gly			
134	335	340	345	
136	gca aaa tgc cga tgt gaa gac tga tattccacgc tggtaaaaaa tgaataaaac			1592
137	Ala Lys Cys Arg Cys Glu Asp			
138	350	355		

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140 cgcgattgcg ctgctggctc tgcttgccag taggccagc ctggcagcga cgccgtggca 1652  
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145 <210> SEQ ID NO: 2  
146 <211> LENGTH: 356  
147 <212> TYPE: PRT  
148 <213> ORGANISM: Escherichia coli  
150 <400> SEQUENCE: 2  
151 Met Ala Gly Asn Thr Ile Gly Gln Leu Phe Arg Val Thr Thr Phe Gly  
152 1 5 10 15  
154 Glu Ser His Gly Leu Ala Leu Gly Cys Ile Val Asp Gly Val Pro Pro  
155 20 25 30  
157 Gly Ile Pro Leu Thr Glu Ala Asp Leu Gln His Asp Leu Asp Arg Arg  
158 35 40 45  
160 Arg Pro Gly Thr Ser Arg Tyr Thr Thr Gln Arg Arg Glu Pro Asp Gln  
161 50 55 60  
163 Val Lys Ile Leu Ser Gly Val Phe Glu Gly Val Thr Thr Gly Thr Ser  
164 65 70 75 80  
166 Ile Gly Leu Leu Ile Glu Asn Thr Asp Gln Arg Ser Gln Asp Tyr Ser  
167 85 90 95  
169 Ala Ile Lys Asp Val Phe Arg Pro Gly His Ala Asp Tyr Thr Tyr Glu  
170 100 105 110  
172 Gln Lys Tyr Gly Leu Arg Asp Tyr Arg Gly Gly Arg Ser Ser Ala  
173 115 120 125  
175 Arg Glu Thr Ala Met Arg Val Ala Ala Gly Ala Ile Ala Lys Lys Tyr  
176 130 135 140  
178 Leu Ala Glu Lys Phe Gly Ile Glu Ile Arg Gly Cys Leu Thr Gln Met  
179 145 150 155 160  
181 Gly Asp Ile Pro Leu Asp Ile Lys Asp Trp Ser Gln Val Glu Gln Asn  
182 165 170 175  
184 Pro Phe Phe Cys Pro Asp Pro Asp Lys Ile Asp Ala Leu Asp Glu Leu  
185 180 185 190  
187 Met Arg Ala Leu Lys Lys Glu Gly Asp Ser Ile Gly Ala Lys Val Thr  
188 195 200 205  
190 Val Val Ala Ser Gly Val Pro Ala Gly Leu Gly Glu Pro Val Phe Asp  
191 210 215 220  
193 Arg Leu Asp Ala Asp Ile Ala His Ala Leu Met Ser Ile Asn Ala Val  
194 225 230 235 240  
196 Lys Gly Val Glu Ile Gly Asp Gly Phe Asp Val Val Ala Leu Arg Gly  
197 245 250 255  
199 Ser Gln Asn Arg Asp Glu Ile Thr Lys Asp Gly Phe Gln Ser Asn His  
200 260 265 270  
202 Ala Gly Gly Ile Leu Gly Gly Ile Ser Ser Gly Gln Gln Ile Ile Ala  
203 275 280 285  
205 His Met Ala Leu Lys Pro Thr Ser Ser Ile Thr Val Pro Gly Arg Thr  
206 290 295 300  
208 Ile Asn Arg Phe Gly Glu Val Glu Met Ile Thr Lys Gly Arg His  
209 305 310 315 320  
211 Asp Pro Cys Val Gly Ile Arg Ala Val Pro Ile Ala Glu Ala Asn Ala  
212 325 330 335

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214 Gly Asp Arg Phe Asn Gly Ser Pro Val Thr Ala Thr Gly Ala Lys Cys  
215 340 345 350  
217 Arg Cys Glu Asp  
218 355  
220 <210> SEQ ID NO: 3  
221 <211> LENGTH: 1713  
222 <212> TYPE: DNA  
223 <213> ORGANISM: Escherichia coli  
225 <220> FEATURE:  
226 <221> NAME/KEY: CDS  
227 <222> LOCATION: (491)..(1594)  
229 <400> SEQUENCE: 3  
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232 gtaaaaaaaa accgaatgcg aggcattccgg ttgaaatagg ggtaaacaga cattcagaaa 120  
234 tgaatgacgg taataaataa agttaatgat gatacgggta gttattctag ttgcgagtga 180  
236 aggttttgtt ttgacattca gtgctgtcaa atacttaaga ataagttatt gattttaacc 240  
238 ttgaattatt attgcttgat gttaggtgct tatttgcaca ttccgcaata atcttaaaaa 300  
240 gttcccttgc atttacattt tgaaacatct atagcgataa atgaaacatc taaaagttt 360  
242 tagtatcata ttctgttgg attattctgc atttttgggg agaatggact tgccgactga 420  
244 ttaatgaggg ttaatcagta tgcagtgccaa taaaaagca aataaaggca tataacagag 480  
246 gtttaataac atg aaa gtt aaa gta ctg tcc ctc ctg gtc cca gct ctg 529  
247 Met Lys Val Lys Val Leu Ser Leu Leu Val Pro Ala Leu  
248 1 5 10  
250 ctg gta gca ggc gca gca aac gct gct gaa gtt tac aac aaa gac ggc 577  
251 Leu Val Ala Gly Ala Ala Asn Ala Ala Glu Val Tyr Asn Lys Asp Gly  
252 15 20 25  
254 aac aaa tta gat ctg tac ggt aaa gta gac ggc ctg cac tat ttc tct 625  
255 Asn Lys Leu Asp Leu Tyr Gly Lys Val Asp Gly Leu His Tyr Phe Ser  
256 30 35 40 45  
258 gac aac aaa gat gta gat ggc gac cag acc tac atg cgt ctt ggc ttc 673  
259 Asp Asn Lys Asp Val Asp Gly Asp Gln Thr Tyr Met Arg Leu Gly Phe  
260 50 55 60  
262 aaa ggt gaa act cag gtt act gac cag ctg acc ggt tac ggc cag tgg 721  
263 Lys Gly Glu Thr Gln Val Thr Asp Gln Leu Thr Gly Tyr Gln Trp  
264 65 70 75  
266 gaa tat cag atc cag ggc aac agc gct gaa aac gaa aac aac tcc tgg 769  
267 Glu Tyr Gln Ile Gln Gly Asn Ser Ala Glu Asn Glu Asn Asn Ser Trp  
268 80 85 90  
270 acc cgt gtg gca ttc gca ggt ctg aaa ttc cag gat gtg ggt tct ttc 817  
271 Thr Arg Val Ala Phe Ala Gly Leu Lys Phe Gln Asp Val Gly Ser Phe  
272 95 100 105  
274 gac tac ggt cgt aac tac ggc gtt gtt tat gac gta act tcc tgg acc 865  
275 Asp Tyr Gly Arg Asn Tyr Gly Val Val Tyr Asp Val Thr Ser Trp Thr  
276 110 115 120 125  
278 gac gta ctg cca gaa ttc ggt ggt gac acc tac ggt tct gac aac ttc 913  
279 Asp Val Leu Pro Glu Phe Gly Gly Asp Thr Tyr Gly Ser Asp Asn Phe  
280 130 135 140  
282 atg cag cag cgt ggt aac ggc ttc gcg acc tac cgt aac act gac ttc 961  
283 Met Gln Gln Arg Gly Asn Gly Phe Ala Thr Tyr Arg Asn Thr Asp Phe

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284	145	150	155	
286	ttc ggt ctg gtt gac ggc ctg aac ttt gct gtt cag tac cag ggt aaa			1009
287	Phe Gly Leu Val Asp Gly Leu Asn Phe Ala Val Gln Tyr Gln Gly Lys			
288	160	165	170	
290	aac ggc aac cca tct ggt gaa ggc ttt act agt ggc gta act aac aac			1057
291	Asn Gly Asn Pro Ser Gly Glu Gly Phe Thr Ser Gly Val Thr Asn Asn			
292	175	180	185	
294	ggt cgt gac gca ctg cgt caa aac ggc gac ggc gtc ggc ggt tct atc			1105
295	Gly Arg Asp Ala Leu Arg Gln Asn Gly Asp Gly Val Gly Ser Ile			
296	190	195	200	205
298	act tat gat tac gaa ggt ttc ggt atc ggt ggt gcg atc tcc agc tcc			1153
299	Thr Tyr Asp Tyr Glu Gly Phe Gly Ile Gly Ala Ile Ser Ser Ser			
300	210	215	220	
302	aaa cgt act gat gct cag aac acc gct gct tac atc ggt aac ggc gac			1201
303	Lys Arg Thr Asp Ala Gln Asn Thr Ala Ala Tyr Ile Gly Asn Gly Asp			
304	225	230	235	
306	cgt gct gaa acc tac act ggt ggt ctg aaa tac gac gct aac aac atc			1249
307	Arg Ala Glu Thr Tyr Thr Gly Gly Leu Lys Tyr Asp Ala Asn Asn Ile			
308	240	245	250	
310	tac ctg gct gct cag tac acc cag acc tac aac gca act cgc gta ggt			1297
311	Tyr Leu Ala Ala Gln Tyr Thr Gln Thr Tyr Asn Ala Thr Arg Val Gly			
312	255	260	265	
314	tcc ctg ggt tgg gcg aac aaa gca cag aac ttc gaa gct gtt gct cag			1345
315	Ser Leu Gly Trp Ala Asn Lys Ala Gln Asn Phe Glu Ala Val Ala Gln			
316	270	275	280	285
318	tac cag ttc gac ttc ggt ctg cgt ccg tcc ctg gct tac ctg cag tct			1393
319	Tyr Gln Phe Asp Phe Gly Leu Arg Pro Ser Leu Ala Tyr Leu Gln Ser			
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322	aaa ggt aaa aac ctg ggt cgt ggc tac gac gac gaa gat atc ctg aaa			1441
323	Lys Gly Lys Asn Leu Gly Arg Gly Tyr Asp Asp Glu Asp Ile Leu Lys			
324	305	310	315	
326	tat gtt gat gtt ggt gct acc tac tac ttc aac aaa aac atg tcc acc			1489
327	Tyr Val Asp Val Gly Ala Thr Tyr Tyr Phe Asn Lys Asn Met Ser Thr			
328	320	325	330	
330	tac gtt gac tac aaa atc aac ctg ctg gac gac aac cag ttc act cgt			1537
331	Tyr Val Asp Tyr Lys Ile Asn Leu Leu Asp Asp Asn Gln Phe Thr Arg			
332	335	340	345	
334	gac gct ggc atc aac act gat aac atc gta gct ctg ggt ctg gtt tac			1585
335	Asp Ala Gly Ile Asn Thr Asp Asn Ile Val Ala Leu Gly Leu Val Tyr			
336	350	355	360	365
338	cag ttc taa tctcgattga tatcgaacaa gggcctgcgg gccccttttt			1634
339	Gln Phe			
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343	ataatcactg acggaaata			1713
346	<210> SEQ ID NO: 4			
347	<211> LENGTH: 367			
348	<212> TYPE: PRT			
349	<213> ORGANISM: Escherichia coli			
351	<400> SEQUENCE: 4			

**VERIFICATION SUMMARY**  
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L:10 M:271 C: Current Filing Date differs, Replaced Current Filing Date